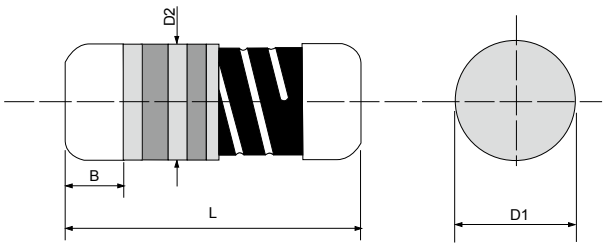
MM
Metal Film MELF Resistor

Quality • Reliability
Cost-Down via Innovation



Specifications Per

- IEC 60115-1
- EN140401-803

Features

- SMD enabled structure
- Anti-sulfuration test qualified
- Excellent solderability termination
- Excellent in heat dissipation than chip resistor
- Stronger mechanical structure to endure vibration and thermal shock
- Products meet RoHS requirements and do not contain substances of very high concern identified by European Chemicals Agency

DIMENSIONS

Type	Body Length (L, mm)	Cap Diameter (D1, mm)	Body Diameter (D2, mm)	Soldering Spot (B, mm)	Net Weight Per 1000 pcs
MM16	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
MM204	3.52 ± 0.15	1.35 ± 0.1	D1+0.02/ -0.15	0.6 Min.	17 grams
MM207	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	80 grams
MM52	5.90 ± 0.20	2.20 ± 0.1	D1+0.02/ -0.2	1.0 Min.	80 grams

GENERAL SPECIFICATIONS

Type	Power Rating At 70°C	Maximum Working Voltage*	Maximum Overload Voltage**	Minimum Resistance	Maximum Resistance	Resistance Tolerance	Available Resistance Values
MM16	1/6W	200V	400V	0, 0.51Ω	10MΩ	±1%	E96
						±2%, ±5%	E48 / E24
MM204	1/4W	200V	400V	0, 0.51Ω	10MΩ	±1%	E96
						±2%, ±5%	E48 / E24
MM207	1/3W	300V	500V	0, 0.51Ω	10MΩ	±1%	E96
						±2%, ±5%	E48 / E24
MM52	1/2W	300V	500V	0, 0.51Ω	10MΩ	±1%	E96
						±2%, ±5%	E48 / E24

For a better life cycle under normal usage, 50% of the rated power is recommended.
For zero-ohm jumper, please see ZMM series. For 1m~510mΩ please see CSM series.
Special sizes and specifications available on request.

*** Rated Continuous Maximum Working Voltage (RCWV) should be determined from RCWV = $\sqrt{\text{Power Rating x Resistance Values}}$ Max. RCWV listed above.**

**** Short-time Overload (STOL) test should be determined from STOL=2.5 x $\sqrt{\text{Power Rating x Resistance Values}}$ or maximum overload voltage listed above, whichever is lower.**

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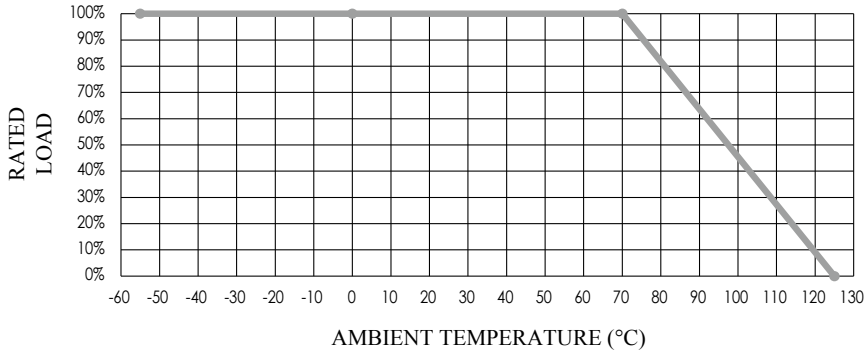
PART NUMBER

Example: MM204F162RTKRTR3K0

MM204	F	162R	TKR	TR3K0
Type	Tolerance*	Resistance	TCR*	Packaging
	Z (Jumper) F (1%) G (2%) J (5%)	162Ω **4-character code** containing - 3 significant digits 1 letter multiplier OHM MULTIPLIER R = 1 K = 10^3 M = 10^6 G = 10^9	50ppm **3-character code** TKP= ± 15ppm TKQ = ± 25ppm TKR = ± 50ppm TKS = ± 100ppm	**5-character code** TR = Tape Reel (pieces per reel) MM16/MM204 3K0 = 3,000 pcs 6K0 = 6,000 pcs** 10K = 10,000 pcs** MM207/MM52 2K0 = 2,000 pcs 6K0 = 6,000 pcs** 10K = 10,000 pcs**

*** Listed values may not be applicable across product types or to all resistance values. Please check with us before placing order. **upon request**

POWER DERATING CURVE



TECHNICAL SUMMARY

Characteristics	Ranges & Limits	
Operating Temperature Range, °C	-55 ~ +125	
Dielectric Withstanding Voltage, VAC or DC	MM16, MM204	200
	MM207, MM52	500
Insulation Resistance, MΩ	>10^4	
Tin Whisker (JESD201 Temperature Cycling & High Temp. / Humidity Storage), μm	<5	
Failure Rate in Time, pcs / 10^9 device hours	<1	

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PERFORMANCE SPECIFICATIONS

Characteristics	Test Conditions	Limits	
Short Time Overload	**IEC 60115-1 4.13** 5 seconds 2.5x rated voltage (not over max. overload voltage)	0.51Ω to 332KΩ	±(0.25%+0.01Ω)
		>332KΩ	±(0.5%+0.01Ω)
Load Life	**IEC 60115-1 4.25.1** Rated load (not over max. working voltage) 1,000 hours with 1.5 hours ON, 0.5 hour OFF, at (70±2)°C	0.51Ω to 332KΩ	±(0.75%+0.01Ω)
		>332KΩ	±(1%+0.01Ω)
Load Life In Humidity	**IEC 60115-1 4.24** 56 days rated load (not over max. working voltage) at (40±2)°C and (93±3)% relative humidity	0.51Ω to 332KΩ	±(1%+0.01Ω)
		>332KΩ	±(2%+0.01Ω)
Load Life In Humidity (accelerated mode)	**IEC 60115-1 4.37** 1,000 hours at 85°C and 85% relative humidity with 0.1x rated voltage (not over 100V)	0.51Ω to <100KΩ	±(1%+0.01Ω)
		100KΩ to 332KΩ	±(2.5%+0.01Ω)
		>332KΩ	±(3.5%+0.01Ω)
Periodic Electric Overload	**IEC 60115-1 4.39** 3.9x rated voltage (not over max. overload voltage) with 0.1s ON, 2.5s OFF for 1,000 cycles	±(0.5%+0.01Ω)	
Resistance To Soldering Heat	**IEC 60115-1 4.18.2** Dip the resistor into a solder bath measured (260±5)°C and hold it for a 10±1 seconds	±(0.5%+0.01Ω)	
Thermal Endurance	**IEC 60115-1 4.25.3** 1,000 hours without load	85°C	±(0.5%+0.01Ω)
		125°C	±(1%+0.01Ω)
Thermal Shock	**IEC 60115-1 4.19** -55°C 30minutes, +125°C 30minutes	5 cycles	±(0.25%+0.01Ω)
		1,000 cycles	±(0.75%+0.01Ω)
Single pulse high voltage overload	**IEC 60115-1 4.27** • 5 pulses of 1.2/50μs at 10x rated voltage (not over 400V for MM16 & MM204; not over 500V for MM207 & MM52) with interval of 12 sec. • 10 pulses of 10/700μs at 10x rated voltage (not over 400V for MM16 & MM204; not over 500V for MM207 & MM52) with interval of 60 sec.	±(0.5%+0.01Ω)	
Electrostatic discharge (Human body model)	**IEC 60115-1 4.38** 3 positive & 3 negative discharges with 2KV for MM16 & MM204 or 4KV for MM207 & MM52 (For continuous surge application please see Surge Performance paragraph)	±(0.5%+0.01Ω)	
Solderability	**IEC 60115-1 4.17.2** Solder area covered after (235±3)°C/(2±0.2) seconds with flux applied	95% min.coverage	
Vibration	**IEC 60115-1 4.22** Six hours in each parallel and axial direction with a simple harmonic motion having an amplitude of 1.52mm and 10 to 2,000 Hz.	±0.25%+0.01Ω)	
Bending test	**IEC 60115-1 4.33** Pressing depth 2mm, 3 times	±0.25%+0.01Ω)	
Flammability	**IEC 60115-1 4.35** Needle flame test 10s	No burning after 30s	
Temperature Coefficient*	**IEC 60115-14.8** At -55˚C to +25˚C and +25˚C to +125˚C as the reference temperature.	±1%, ±2%	±15, ±25, ±50, ±100 PPM/°C
		±5%	±100 PPM/°C

*** Not applicable to all resistance values. Please check with us regarding the PPM of specific resistance value(s).**

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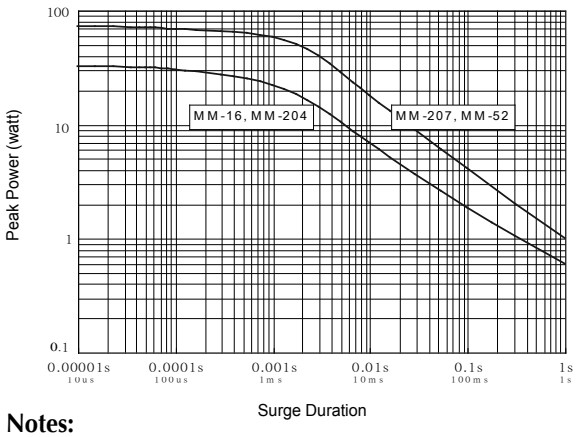
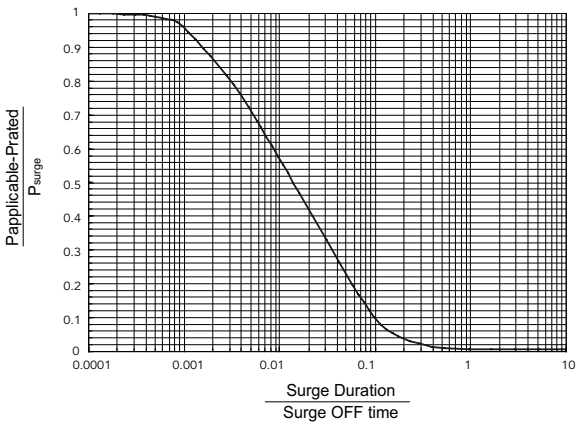
SINGLE SURGE PERFORMANCE



SURGE POWER DERATING CURVE



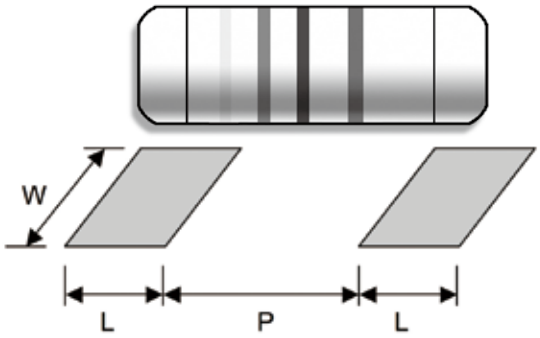
Notes:

• SINGLE SURGE PERFORMANCE graph is good for NON REPETITIVE applications operating in an ambient temperature of 70°C or less. For temperatures above 70°C, the graph power must be derated further linearly down to zero at 125°C.

• To determine applicable surge power in continuous-surge applications:

1. Identify allowable duration and peak power P_{surge} of single surge;
2. Determine ratio of surge duration/surge OFF time in application;
3. Calculate $P_{applicable}$ backwardly according to Y-axis of SURGE POWER DERATING CURVE.

SUGGESTED PAD LAYOUT



Type	Soldering Mode	Pad Length (L, mm, Min.)	Pad Spacing (P, mm)	Pad Width (W, mm, Min.)
MM16 MM204	Reflow	1.3	1.6 ± 0.1	1.6
	Wave	1.5	1.5 ± 0.1	1.8
MM207 MM52	Reflow	2.0	3.0 ± 0.1	3.0
	Wave	2.5	3.0 ± 0.1	3.0

For better heat dissipation / lower heat resistance, increase W & L.

COVER TAPE PEELING SPECIFICATION

Recommended peeling force: 50±5gf

